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The Application of Data Mining to Develop Web-Based Referral Information Management System for Dera Woreda Hospitals and Health Centers

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ABSTRACT

  Medical Referral Systems aim at achieving high standards of care by improving patient outcomes and decreasing costs through optimal use of medical services. The success of these systems is highly dependent on the quality of referral decisions [1].Web based referral Information management system present a multitude of potential benefits for health system especially for those in low-income developing countries. For instance, web based referral can facilitate many specialist to conduct consultation with out the need for a patient to see the specialist, improve care condition among health facilities by reducing unnecessary face to face specialty visits and make efficient handling of referred patient data. In general, it improves quality of care in referral unit through timely and informed decision. A referral system implemented in Ethiopia currently faces a lot of problems. It is much worse in case where the complication is involves life saving issues [2]. To mention some of the problems seen: patient to be served could not determine in advance that results in varied number of referred patient in different hospitals, poor communication and integrated system service provision prior to service delivery , delay in placement of patients, fragmented service delivery and paper based patient referral system contribute to its inefficiency [2]. This research will use an objectoriented analysis and design methodology which is a system development methodology to model, design and implement the required web-based referral information management system for referral centers in Dera Woreda.

Keywords: Datamining**,** Web-based Referral Information Management System, Objectoriented, Analysis, Design, Hospitals, Internet, Dera

1. INTRODUCTION

Ethiopia is the second populous country in Africa that shows the lowest health status in the world [3]. Ethiopia's health care system is among the least developed in Sub-Saharan Africa and is not at present able to effectively cope with the significant health problems facing the country. Widespread poverty, poor nutritional status, low education levels and poor access to health services have contributed to the high burden of ill health in the country [4].

Dera is one of the woreda in the Oromia Region of Ethiopia. Part of the Semien Shewa Zone, Dera is bordered on the south by the Jamma River which separates it from Hidabu Abote and Wara Jarso, on the west, north and east by the Amhara Region; the Abay River defines the western boundary, and its tributary the Walaqa the northern. https://en.wikipedia.org/wiki/Dera,_Oromia_(woreda) Dera is the largest and the most populous woreda in the North Shewa Zone. Some of the problems faced by the office service include poor health information and lack of integration and co-ordination in service delivery that resulted in poor health service delivery and quality care, not meeting the satisfaction level of the end users [3].

In countries like Ethiopia with scarce specialized human resource for health, patients are usually referred with the purpose of contributing to the effort to reduce the critical shortage of specialized human power [5]. The process of generating a clinical referral for a patient and the resulting transfer of information among hospitals and health centers are key components in the struggle to deliver less costly and more effective clinical care. Modern patient care requires collaboration among health care workers belonging to various functional units, departments and hospitals.

However, the qualities of health care in Ethiopia still undermined by weak referral systems. Hence it becomes apparent that bringing technology to support referral system which is effective, accessible, integrated and efficient has a great importance.

Referral management systems include web-based referral, services directories, and referral tracking systems and secure email facilities to enable communication between health professionals in primary, community and secondary care [6].

The web-based technology that is facilitated by internet provides a multifaceted benefit in improving the existing referral system in Ethiopia. Some of the benefits it brings include timely provision of service to save life through well-organized communication, efficient allocation of patients, a means of sharing and retrieving patient medical details related to referral services provision that enhance timely service delivery.

On top of this, modern patient care requires collaboration among health care workers belonging to various functional units, departments and hospitals. However, the qualities of health care in Ethiopia are still undermined by weak referral systems. The current referral system in Addis Ababa organized to include all health centers and hospitals. The referral done first at health centers and hospitals accept the referred patient based on their catchment area. The major gaps seen in the existing referral system includes transferring referred patients data with incomplete socio-demographic and clinical information which make the diagnosis process in hospital difficult,

delay in patient placement process, paper - based referred patient data recording system at health centers, poor communication and fragmented service delivery among referral health facilities [2].

In general sharing patient referral data over the web is cost effective and fast that gives health care providers easy access to information from any locations. Therefore, it is possible to deign and develop a web-based referral system for health care providers in Dera to strengthen integrated health care service provision.

At the end, the study will develop a web-based referral information management system for hospitals and health centers.

1.1. Referral Systems

Referral systems are critical components of quality clinical care in any healthcare system. They are determinant factors for the cost-effectiveness, efficiency and quality of patient care. These valuable medical systems contribute to high standards of care by limiting over-medication, permitting an efficient division of tasks between generalists and specialists, freeing specialists to develop their special knowledge, and by decreasing the cost of medical care [1].

Referral systems can be described in terms of three important attributes: referral structure, referral process, and referral policy. A referral structure describes the organization of healthcare providers and referral process refers to flow of patient referrals among these providers. Referral policy refers to a set of guidelines and procedures designed to govern the way providers should process patient referrals.

1.1.1. Referral Structure

A referral system is commonly structured into primary, secondary and tertiary care. Primary care medical services are provided by a physician or other health professional who has first contact with a patient seeking medical treatment or care. Secondary care medical services are provided by medical specialists for a patient referred by a primary care provider who first diagnosed or treated the patient. Tertiary care medical services are provided by specialist hospitals equipped with diagnostic and treatment facilities not generally available at local hospitals [1].

In the Ethiopian case, healthcare providers are structured in a four-level pyramidal hierarchy (see Figure 1.1.) [1] In this structure, healthcare centers are organized as primary care providers. On the other hand, hospitals are organized as primary, secondary and tertiary referral hospitals depending on their level of facilities to provide medical services.

a. **Primary Care Providers:** These are healthcare centers, which provide primary care services to patients. Each primary care provider is organized in a way to give healthcare services for approximately 25,000 people.

b. **Primary Referral Hospitals:** These are district hospitals supposed to provide healthcare services that could not be managed by primary care providers. Each primary referral hospital is intended to offer healthcare services for about 250,000 people [1].
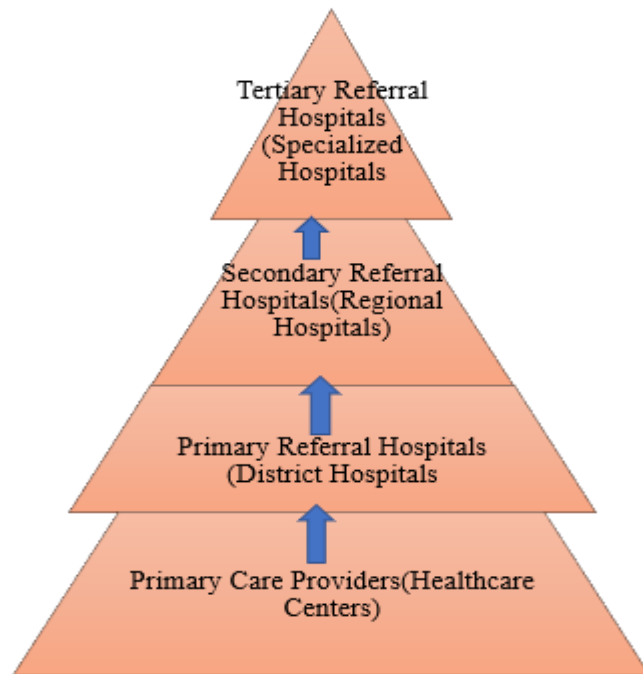
Tertiary Referral
Hospitals
(Specialized
Hospitals

Secondary Referral
Hospitals(Regional
Hospitals)

Primary Referral Hospitals
(District Hospitals

Primary Care Providers(Healthcare
Centers)

Figure 1.1. *Structure of Ethiopian Referral System*

c. **Secondary Referral Hospitals:** These are regional hospitals that are assumed to provide healthcare ser-vices that could not be managed by primary referral hospitals. Each secondary referral hospital is intend-ed to provide healthcare services for approximately 1,000,000 people.

d. **Tertiary Referral Hospitals:** These are specialized hospitals supposed to provide specialized healthcare services that could not be managed by primary or secondary referral hospitals. Each tertiary referral hos-pital is intended to offer healthcare services for about 5,000,000 people [1] .

1.1.2. Referral Process

The referral process deals with the generation of a clinical referral for a patient and the resulting transfer of in-formation from a referring provider to a referred-to provider and back again to the referring provider Patient referral can be initiated either by health-care providers or by patients. Patient referral initiated by a patient's health-care provider to see a specialist for a problem that is not being managed adequately by his/her current provider is known as *physician referral*. Alternatively, patient referral initiated by a patient to contact with a specialist on his/her own, avoiding the involvement of a referring physician is known as *self-referral*. Both types of referrals are usually initiated for the reasons of diagnosis, treatment, surgery, or second opinion of a

problem. In the Ethiopian case, self-referrals are not common and hence, they will not be addressed in this work [1].

1.1.3. Referral Policy

Referral policy refers to a set of guidelines and procedures used to direct how patient referrals should be processed. It can be defined at different levels (local, regional, or national) and is supposed to be employed by providers in sending and receiving patient referrals. [1] In the Ethiopian case, though it is not complete and fully functional, there is a referral guideline that is intended to ensure efficient flow of patients from provider to provider. According to this guideline, the national referral system is supposed to operate at the level of regional states. Hence, it is the responsibility of each region to define a referral map of healthcare providers in line with the national referral guideline. The referral map is defined according to population size, distance between providers and type of services provided. It shows which provider can make/receive referral to/from which provider for which services. Each provider is expected to process patient referrals according to this map and the national referral guideline.

2. Related Work

2.1. Related data in Ethiopia

To the knowledge of the researcher, no study has been found develop a web based referral information management system in Ethiopia. Hence, this study will try to contribute new application for referral information management system in Dera Woreda referral centers. But some the researcher work are [2]Improving existing referral system through using Web-based Referral Information Management system becomes an important step that have to be taken in enhancing the quality of referral service provision in Ethiopia Data mining can be used to model health care problems. This [7] research aimed to apply data mining techniques to patients' data to establish meaningful relationships or patterns for effective TB diagnosis and also listed in the following Table 1.1. Summary of related work [2], [1], [7]

Author and year	Title	Method and Feature extraction
Akale Regassa (2012)	Developing Web-Based Referral Information Management System For Hospitals And Health Centers In Addis	Data Mining

	Ababa	
Zewdu Gebeyehu Worku (2007)	Multi- Agent Referral Decision Support	A **M**ulti-**C**riteria **P**rovider **S**election (MCPS) model
Asia Nesredin (2012)	Mining Patients' Data For Effective Tuberculosis Diagnosis: The Case Of Menelik II Hospital	Mining Data
Amanuel Degu (2009)	Design and Implementation of Web Based Telemedicine System using Service-Oriented Architecture (SOA)	Service-Oriented Architecture (SOA)

Table 1.1. Summary of related work

3. **Rationale for the Study**

In countries like Ethiopia strengthening the referral system is absolutely essential to reducing morbidity and mortality. However, in developing countries including Ethiopia, the referral system is often weak. It is the task of health referral management system to quickly and easily deliver treatment for patient who is referred. [2]The consequence of not getting timely treatment results in loss of life which can be improved through an effective, efficient and integrated Web-Based Referral Information Management System for Dera Woreda Hospitals and Health Centers that incorporates health care providers.

In response, referral health care providers in Ethiopia have to implement Web-Based Referral Information Management System for Dera Woreda Hospitals and Health Centers for providing service that [2]

- Brings faster and simpler referral system which facilitates management of referred patient medication data and timely communication among service provider.

- Helps referral service provider to make possible redirection of patient to different facility prior to service delivery.

- Makes easy to share best practices among technical staff and timely report generation.

- By taking the advantage introduced by Web-Based Referral Information Management System for Dera Woreda Hospitals and Health Centers, the researcher strongly believes that developing Web-Based Referral Information Management System for Dera Woreda Hospitals and Health Centers has an enormous benefit in providing a better referral system in particular and health care system in general in Ethiopia.

4. **Methodology**

Web-based applications are becoming business critical, and that this would be reflected in the organization of

the development work. The methodology applied to develop any system greatly affects the system efficiency in various aspects. Through taking this into consideration, this study employed a Web-based methodology rooted from the literature reviewed in previous chapter, a new methodology for Web-based system with some modification. The selected methodology helps the researcher to understand the existing referral system as well facilitates the development of the new system, Web-Based Referral Information Management System for Dera Woreda Hospitals and Health Centers [2]. In order to meet the objectives of the project, the researcher has performed requirement gathering and analysis prior to employing an Object-oriented Analysis and Design methodology. Analysis, design and implementation of the proposed system, Web-based Referral Information Management System for Hospitals and Health Centers in Dera Woreda is performed. UML tools for analysis, design phases and programming tool Java, web application scripting language JSF, JSP embedded with HTML and MySQL database language was employed. Integration of developed modules and testing was the final task performed to bring the system functional.

Data collection methods

- **Observation:** we need to observe how existing system is working to get some hit which enables us to develop correct computer based algorithms for each task.

- **Document** review**:** we prefer to review existing document of Dera health system to understand how data is managed and processed in existing system.

- **Interview:** we need face to face communication with Dera health center, other office staff members, and customers because of the data obtained from them are used us as the entry point to dig out the problem in detail and identify their requirements from our system.

Web-applications are becoming increasingly business critical, and that this would be reflected in the organization of the development work. Development of web-sites (a set of web-pages) differs a lot from development of web-based information systems. The latter "supports work, and is usually tightly integrated with other non-web Information Systems such as databases and transaction processing systems".

For developing web-based referral information management system of referral service provision unit the study will use an object-oriented analysis and design methodology. Object-oriented analysis and design (OOAD) methodology is a model-driven technique that integrates data and process concerns into constructs called objects. OOAD uses UML (Unified modeling language) tools to model the system's objects with pictures with various perspectives such as structure and behavior. UML is a notation that allows the modeler to specify, visualize and construct the artifacts of software systems, as well as business models.

In OOAD methodologies, a series of life cycles is followed called objectoriented system development (OOSD) life cycle. OOSD life cycle is a process of progressively developing a representation of a system component or object through the phases of analysis, design, implementation and testing.

4.1. Object-Oriented Analysis and Design methodology

OOA/D methodology applied in this study integrate referral data used in referral centers and process concerns which acts on a referral data in providing the required service for clients, patients, in referral system into constructs called objects. It follows a modular approach for each concepts identified in referral systems which is easier to understand, correct and modify, that makes it more popular and preferable methodology for this study [2].

The methodology employed helps to analyze and design a system requirement identified from requirement document from an object-oriented point of view. There are many tools available for designing and developing OO systems whereas this study uses Java, a well-known object oriented programming languages, for developing WRIMS for Addis Ababa referral hospitals. In relation to employing an OOA/D methodology for developing WRIMS, UML (Unified Modeling Language) artifacts is used to model the system's objects with pictures with various perspectives such as structure and behavior. OOA phase in developing Web Referral Information Management System emphasizes on investigation of the problem and requirements, for referral facilities rather than a solution. It is also called requirement analysis. It focuses on issues like *how will the existing referral system be used? What are its functions?* To create the best solutions, the study follows a detailed need analysis of data from requirement document for determining user's requirements (i.e., defining *what* the system is supposed to do). Compiling a list of system requirements guides the researcher to analyze the system. To capture what a proposed system should do, the study employed a technique and tool from UML artifacts including:

- Conceptual modeling that helps the researcher to capture concepts in the referral system with their attributes independent of implementation details.
- Data modeling used to represent persistent database objects in referral system.
- UI flow diagramming is applied to show the high level architectural view of system UI.

4.2. Web-based System Development Phases

In developing Web Referral Information Management System the study used an OOSD (Object Oriented System Development) life cycle, a series of life cycles followed in OOA/D methodologies. It allows developing the system under study progressively with a representation of referral system component or object through the phases of object oriented analysis, object oriented design and implementation [2].

3.3. Implementation

In previous phases of developing Web Referral Information Management System Dera Woreda, the study used an OOA/D methodology for analyzing and designing purpose. Ultimately, designs can be implemented, and the implementation such as code expresses the true and complete realized design and it includes the choice of programming tool used to develop the required system.

So for this phase the study employed the programming tool:

- Java Enterprise Edition (Java EE) application, an object oriented programming language is used to implement classes which can be best used in designing Web Referral Information Management System. J

- SF (Java Server Faces), JSP (Java Server Page) a server side scripting language, HTML, a client side web development language is in use for implementing web application.

- MySQL Enterprise Edition for developing object database which mainly contains referred patient medication, system user and patient allocation data on referral network with all data management mechanisms , access, store, update and delete, is defined.

After developing the prototype of the system using the above application tools separately integration and testing of application is performed. Testing is last task performed in OOSD life cycle which brings the system to deployment. The task in testing includes checking the correctness of codes written at development stages to verify the system full and functional.

4.4. Data Collection methodology

4.4.1. Data source

The data sources for this specific research are the referral unit service staff including physicians, health officers, nurses and technical staffs who involves in tasks related to referral service, documents used for processing referral data and referral service provision environment at health centers and hospitals in Dera Woreda governmental health care providers. For the purpose of requirement gathering which provides an input for OOA/D stages of developing the system and understanding the existing system, the study used the following data gathering tools.

4.4.2. Sampling

As activities performed and rules and policy procedures followed to process referral information by individual at referring and referred facility are similar, the study used random sampling techniques to selects sample referral centers. Then 1 hospital, Dera Gundomeskel primary Hospital and 7 Health centers, **Gundomeskel**, **Racho**, **Tuti**, **Karra**, **Cheka**, **Selelkulla**, and **HarbuMeskel** health center managers were selected randomly and interviewed. In addition, two Health officers from selected hospital and one Nurse and one physician from health centers were involved in the process of developing the system under study through providing comments if there was a requirement missed or incorrectly included.

3.5.3 Data Gathering Techniques

The study employed the following data gathering techniques for collecting data, user requirements, from sampled subjects of the population.

Interview

Most analysts use interviewing as a primary way of gathering requirement in information system projects. The study conducted an in-depth interview on 1 hospital and 7 health centers, 8 managers to gather facts and business processes followed to provide referral service in the existing system and additional requirement need to be

filled with the new system being developed. Indeed, interviews, open- ended type are important methods to obtain rich information; the study used open- ended type which has 3 parts.

- The first part includes questions which helps the researcher to clearly understand the overall view of the current referral system.

- The second part tries to identify issues related to the performance of the existing system.

- The final part focuses on identifying the changes required in the existing system which can be integrated with the system under study.

Observation

The study employed observation for getting some issues which can be gathered through other data gathering techniques from referral centers. It includes the waiting time for patients to get service for understanding the efficiency of the existing system, the availability of infrastructure and the difficulties seen in the referral service provision process.

5. **WEB-BASED SYSTEM DEVELOPMENT**

5.1. **Web-based Architecture for Web Referral Information Management System Dera Woreda**

Applications in Web-based system are usually broken into logical chunks called "tiers", where every tier is assigned a role. Traditional applications consist of only 1 tier, which resides on the client machine, but web applications lend themselves to n-tiered approach by nature. Though many variations are possible, the most common structure is the three tired application. In its most common form, the three tiers are called *presentation*, *application* and *storage* [2].
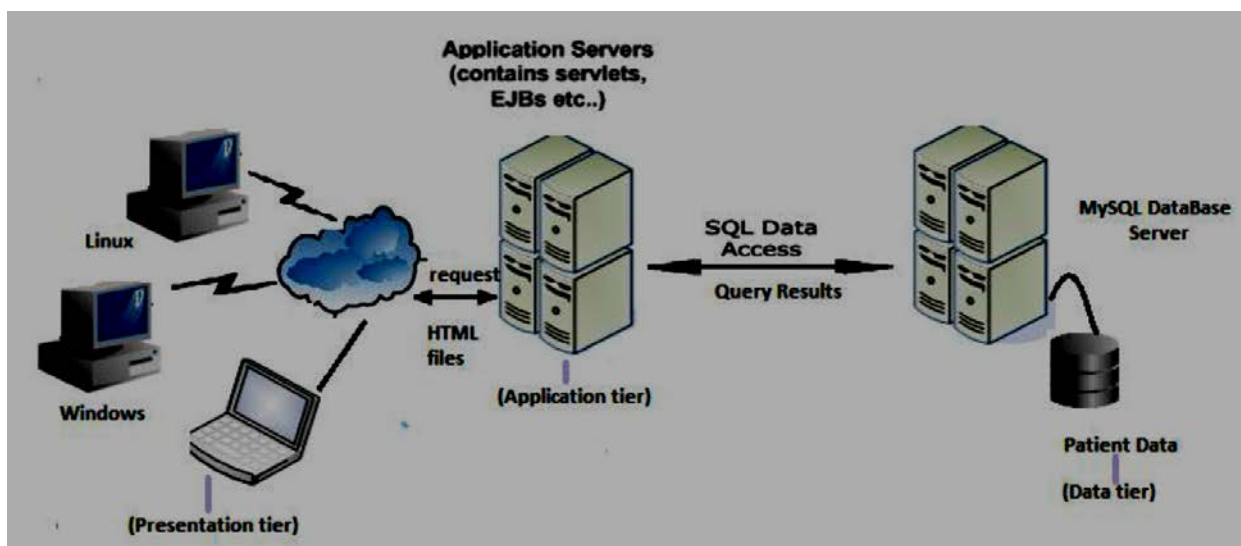

Figure 1.2. *3 Tier Architecture for Web-based System*

Presentation tier: provides user interface on clients' browser and used to translate tasks and results to something the user can understand.

Application tier: sometimes called logic tier that coordinates the application, process commands, make logical

decisions and evaluations, and performs calculations. It also moves and process data between the two surrounding tiers [2].

Data (storage) tier: store and retrieve information from database system. The information is then passed back to the application tier for processing and then eventually back to the user [2].

5.2. Requirements Analysis of the Existing System

Requirement phase of system development life cycle identify requirement of the existing referral system and use that as input for the succeeding system development phases, OOA. Requirement analysis is done based on the requirements gathered from interviews and document analysis with potential users of the referral system users and finally organized under requirement specification for Web Referral Information Management System Dera Woreda. Use case, UML notation that visualize user requirement is used in this phase.

5.2.1. Essential use case

Essential use case is used to explore usage-based requirements in the existing referral system. It is technology independent. It describes the fundamental business task of the existing referral system without bringing technological issues into account. Often referred to as a task case model or an abstract use case model, models a technology- independent view of your behavioral requirements. Use-case can be shown using use case description which is the textual scenario and use case diagram, pictorial representation of use case stories [2]. The identified use cases are described using textual description and use case diagramming as follows.

1. Use case Diagram for essential use case modeling
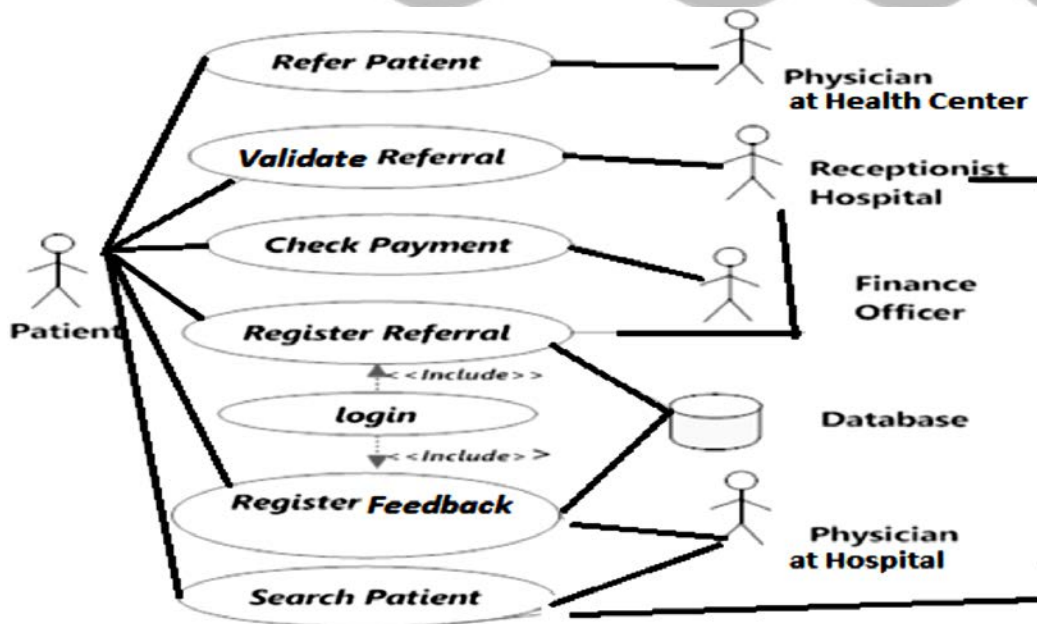
2. Use case description for essential use case modeling

Use case UC1: Refer patient

Scope: Referral at Health center

Primary actor: Patient

Pre-condition: Physician determine on referral indication of patient.

Successes guarantee (post-condition): The patient is referred and allocated.

Main Success scenario (Basic flow):

1. The use case starts when the triage selects the appropriate provider.

2. The triage registers patient referral data on referral form.

3. The triage registers patient general medication information on referral register book.

4. The triage at health center sends referral form to hospital.

5. The use case ends.

Use case UC2: Validate referral

Scope: Referral at Hospitals

Primary actor: Patient

Pre-condition: Patient with referral form.

Successes guarantee (post-condition): The patient referral data being approved.

Main Success scenario (Basic flow):

1. The use case starts when the triage checks the catchments area for referred patient.

2. If the referred patient is from the right catchments area. [Alt 2.1]

3. The triage verifies the completeness of referral data from referral form.

4. If the referral forms data is complete and correct.[Alt 4.1]

5. The triage registers the treatment route on referral form.

6. The triage registers patient general information in register referral book.

7. The use case ends.

Alternative Scenario:

2.1 The triage returns the patient to referring facility.

4.1 The triage returns referral form to referring facility.

5.3.Non-Functional Requirements

Nonfunctional also called technical requirements that describe the quality aspect of the system. This study identifies the following technical requirements in developing Web Referral Information Management System Dera Woreda.

- The system should be available to all appropriate individuals along with their corresponding privileges.

- The system should be able to recovers from any kind of failure like power supply.

- The system is expected to have less response time.

- The system should use password and user name for authentication to enter the system and security password for the different functionalities of the system.

- The system should be implemented on a high speed computer.

5.3.1. Business Rule Identification

Business Rule 1: *Validate Referral Information*

Description: validates whether the input fields for referral forms are filled correctly and important fields are not missed and input fields should be filled by appropriate input types.

Business Rule2: *Check Catchment Area*

Description: Health centers have to check catchment area before referral was done.

Business Rule3: *Redirect to Alternative Facility*

Description: The health centers have to check the capability of the hospitals before allocating patients.

Related rule: Hospitals can redirect patient to another facilities if it is beyond their capability.

Business Rule4: *Settle Financial Issue*

Description: The patient must solve all financial related issues before getting referral service at hospitals.

Business Rule5: *Alert for new information*

Description: Health centers have to alert hospitals for emergency case through e-mail and Hospitals have to access all referrals once a day.

Related Rule: Hospitals should alert health centers if the need for further information [2].

5.4. Conceptual/ Domain Modeling

A domain model, also called conceptual models, domain object models, and analysis object models, is the most important and classic model in OOA. It illustrates important concepts in a real world domain of the referral system. It is a visual representation or perspective of conceptual classes or real-situation objects in a referral domain, not a software perspective and illustrated with a set of class diagrams in which no operation, method signature are defined [2].

The importance of domain model in developing Web Referral Information Management System Dera Woreda is that it helps the study to use real world domain in creating software class and fulfills the representational gap between how stakeholders in referral system conceive the domain and its representation in software.

Domain model provides a conceptual perspective in referral systems and it may show

- Domain objects or conceptual classes

- Associations between conceptual classes

- Attributes of conceptual classes

Concept	Attribute	Method	Description
Physician	User name Password First name Last name Department email address	Login Add Feedback Edit Feedback Show feedback Show Referral Add Referral Edit Referral	The physician handles feedback and referral data. To perform this S/He has to login.
Users	Id first name last name since(refer date) user type user name Password	Login Allocate patient Add user	The receptionist at health handles patient allocation. The users have to login before using the system. System administrator with privilege to add user to the system
Feedback	Card number Serial number date Referred Hospital Name First Name Last Name diagnosis Treatment Given finding Physicians Name	Set Get	Feedback form contains treatment result and processed by physician.
Referral	Card Number Serial Number	Set Get	Referral form contains referred patient

	date Department Referred Hospital Name Referring Health Center Name Clinical Finding diagnosis Investigation Result Treatment Given First Name Last Name dob sex Kebele House Number Occupation Town		data which is processed by physician at health center and hospitals
Patient Allocation	Card Number cases Referring Health Center Name Referred Hospital Name First Name Last Name Date	Set Get	Patient placement handled by health centers receptionist.
System(user manager)	User Type User Name Password	Use	The system verifies user account Information.
Invalid Us-		Display	A message displayed for invalid user

er Exception			
Referral Database Connection	Connection statement query result	Is Connected write read close Set	A referral database that lets the user to insert, read data from database.

Table 1.2. Web Referral Information Management System Dera Woreda identified attributes
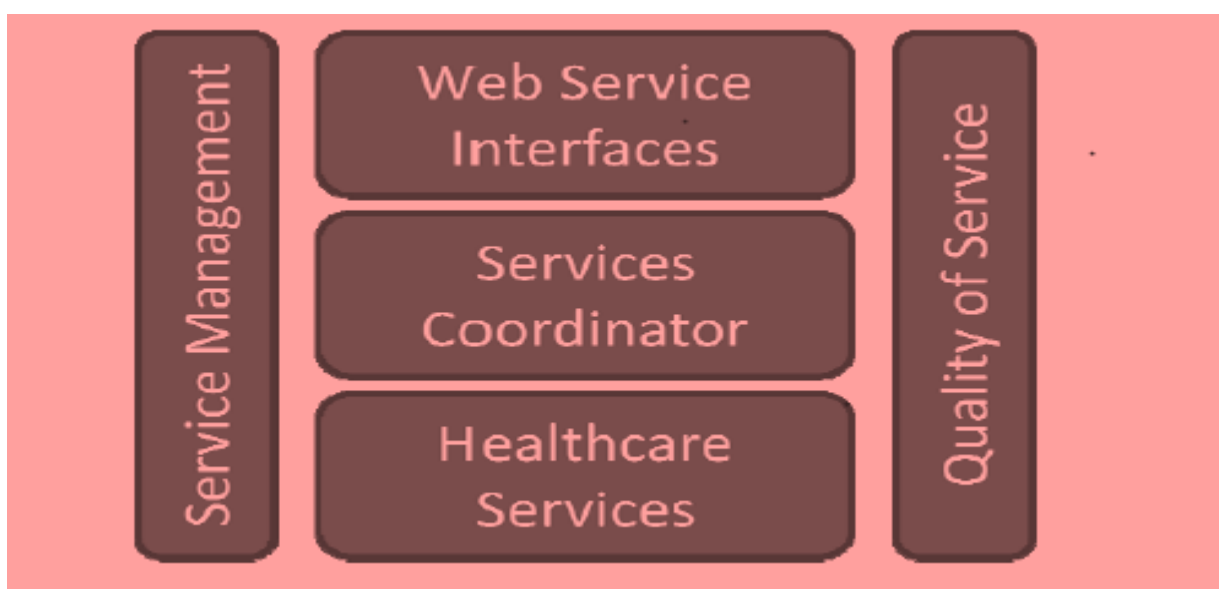
5.5. Service Management

Figure 1.3. E-Health Service Layer

6. Application of Result

Therefore, in this project the researcher developed a Web-based System, Web-based Referral Information Management System for Hospitals and Health Centers in Dera Woreda that helps referral service providers to refer, allocate and redirect patients to alternative facilities with minimal time. A database is developed with integration to web application that improves management of referred patient data at all referral centers, using developed databases the users at referral center can access referral data, anywhere and anytime. Finally, Web-based Referral Information Management System for Hospitals and Health Centers in Dera Woreda tested and evaluated by users at referral centers.

7. Conclusion

Improving the existing referral system using Web-based Referral Information Management system plays an important role in enhancing the quality of referral service provision in Ethiopia. It has a great impact in reducing morbidity and mortality rate by providing on time referral service which can be achieved through effective

communication, coordination, sharing of patient medication data using Web-based system. The effective use of information and technology is crucial for health care organizations to stay competitive in today's complex, evolving environment. The challenges faced when trying to make sense of large, diverse, and often complex data source are considerable. In an effort to turn information into knowledge, health care organizations are implementing data mining technologies to help control costs and improve the efficacy of patient care. Data mining can be used to help predict future patient behavior and to improve diagnosis and treatment programs [7].

8. **Recommendation**

The study tried to realize the proposed Web-based Referral Information Management System under the objective of addressing the shortcomings of existing referral system. However, the researcher did not believe that the system is generic enough to incorporate potential issues in Web-Based Referral Information Management System. For instance, despite the importance of the issues, the study did not include the system for handling financial issues which is related to referral service provision.

The point that we recommend strongly:

- To explore the resource requirement, such as financial, technical, human resource and material, for referral health care providers at country level to expand and adopt Web-Based Referral Information Management System for Dera Woreda Hospitals and Health Centers.

- To expand Web-Based Referral Information Management System for Dera Woreda Hospitals and Health Centers that includes external stakeholders, such as insurance companies for resolving financial issues related to referral service and

- To explore the possibility of providing direct online service to patients in need of referral service including electronic consultation and booking service through direct contact of patient with health care providers if there is no need for face to face specialty visits.

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